



Saura-The Hybrid Car

A.PRAMOD KUMAR

B.Tech Student, Dept of MECH
Nishitha college of Engineering & Technology
Hyderabad, Telangana, India

M.NIRISH

Assistant Professor, Dept of MECH
Nishitha college of Engineering & Technology
Hyderabad,, Telangana, India

Abstract: The main objective of the project is to design & fabrication of a E-Car body which includes design of chassis, steering mechanism and the upper body to place the solar panels by using materials like cast iron, mild steel, GI sheets.

The casting is done by using arc-welding process. The chassis and the body are designed by using AUTO CAD and PRO-E software.

Using this methodology, engineers can define the frame of a new car body respecting the company standards. The principal benefit is the reduction of the design development time as the modification process is optimized. There will be a huge reduction in the weight of the body comparing to other which will lead to decrease in production cost as well as increase in its efficiency.

I. INTRODUCTION

To stay competitive in a global market companies push to make their product development process more efficient with respect to added customer value, shorter time to market, efficient knowledge and technology transfer. To achieve this they depend on the choice of work procedures, suitable processes, methods, available knowledge and experiences, CAE tools and appropriate competence to manage the mentioned for concept creation and concept realization. We are introducing a **Hybrid Vehicle**

Hybrid vehicle:

A Hybrid vehicle is the one which can be powered by more than 2 ways. In this the vehicle is powered by the following 3 ways.

1. By normal Charging of the battery
2. By Charging the battery with the help of Solar Panels
3. By Charging the battery with the help of Engine-Dynamo Mechanism

In this hybrid vehicle we are giving power to the vehicle i.e., Electrical Energy by the above following 3 ways. A Part from the engine- dynamo all the mechanisms used in this vehicle is Eco-friendly.



BACK GROUND OF THE VEHICLE

I feel like doing something for me and having it turn out great. Driving a vehicle that I have modified and made of my own is a great experience. It's not the same as going down to the

local car lot and picking it out, it begins to have its own personality.

There is a great sense of independence with owning a Hybrid car; we are so much less dependent on external factors. In an IC Engine car we have no control over the price of oil and limited control over servicing the car and buying replacements for all the components. A Hybrid car, especially one coupled with solar panels at home for recharging, allows total control over the source of energy used to power the vehicle. It is an eco-friendly. It is very far away from the harmful gases and noise pollution. And it is of low cost initially and maintenance too.

Hence by this the power no longer lies in the hands of oil companies but lies with the consumer. This is perhaps one of the reasons that electric cars are opposed by those who are in the power. In this Hybrid car the Motors and engine only the rotating parts and it is very noise free. We can use the Engine-Dynamo mechanism only in the time when the power from the other two sources (i.e., battery, solar) is stopped. This may be only in the night times when we think for going to a long drive. So, the hybrid vehicle is an eco-friendly vehicle.

II. THE MAIN PROBLEM

The main problem facing in the present day E-Cars are as follows:

- They consist of a single motor.
- They consume high power.
- They consist of compact body design.
- They have more number of rotating parts.
- The body design can't be changed according to the desire of owners of the vehicle.
- The design is too complex.

In order to overcome the above problems one should had to design in such a way that it should eliminate all the above problems. By overcoming all the above mentioned problems we made a

design with the solutions to the above problems with our “Hybrid Car”. The solutions are:

- It consists of 2 motors which are of very high torque
- The power consumption is very low
- The body design is too vast so that it could have good space
- It consists of only two rotating parts i.e., engine, motors.
- The shape of the vehicle is designed in such a way that we can design any kind of body frame according to our wish on the chassis.
- The design is too easy while comparing with the normal E-Car design.

CHASSIS

A chassis consists of an internal framework that supports a man-made object. It is analogous to an animal's skeleton. An example of a chassis is the under part of a motor vehicle, consisting of the frame with the wheels and machinery

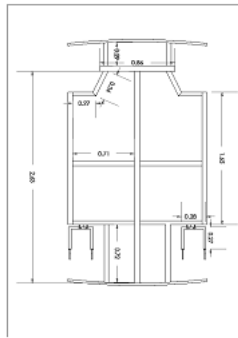
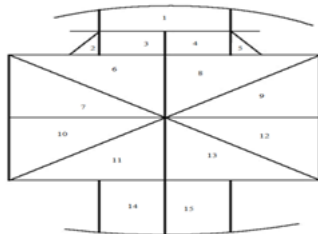


FIG 1: DESIGN OF CHASSIS

As per our design and our requirements we have suggested the above design for preparing chassis. The suggestible material for preparation of the chassis is rectangular hollow pipes of cast iron (2”X1”)

Calculation of moment of inertia for chassis:



For the calculation of M.O.I the chassis is divided into 15 sections

And the M.O.I is first calculated individually and then it is added to find the M.O.I of chassis

$$I_1 = bd^3/12$$

$$= 0.86*0.29^3/12$$

$$= 0.00175m^4$$

$$I_2 = I_5 = bh^3/36$$

$$= 0.14*0.31^3/36$$

$$= 0.000116 m^4$$

$$I_3 = I_4 = bd^3/12$$

$$= 0.3*0.31^3/12$$

$$= 0.000745 m^4$$

$$I_6, I_7, I_8, I_9, I_{10}, I_{11}, I_{12}, I_{13} = bh^3/36$$

$$= 0.71*0.825^3/36$$

$$= 0.011 m^4$$

$$I_{14}, I_{15} = bd^3/12$$

$$= 0.3*0.72^3/12$$

$$= 0.00933 m^4$$

$$I = \sum I_i$$

$$= 0.00175 + 2*(0.000116) + 2*(0.000745)$$

$$+ 8*(0.011) + 2*(0.00933)$$

$$= 0.110132 m^4$$

Calculation of Centroid of Chassis: We know that in order to calculate the Centroid we need areas of simple figures and Centroid of figures i.e., sections.

AREAS OF SECTIONS:

$$A_1 = b*d = 0.86*0.29$$

$$= 0.2494 m^2$$

$$A_5 = A_2 = 0.5*b*h$$

$$= 0.5*0.27*0.34$$

$$= 0.0459$$

$$A_3 = A_4 = b*d$$

$$= 0.3*0.31$$

$$= 0.093$$

$$A_6 = A_7 = A_8 = A_9 = A_{10} = A_{11} = A_{12} = A_{13} = 0.5*b*h$$

$$= 0.5*0.71*0.825$$

$$= 0.293$$

$$A_{14} = A_{15} = b*d$$

$$= 0.31*0.72$$

$$= 0.223$$

FRAME

A frame is the main structure of the chassis of a motor vehicle. All other components fasten to it; a term for this is design is body-on-frame construction.

In 1920, every motor vehicle other than a few cars based on motorcycles had a frame. Since then, nearly all cars have shifted to unit-body construction, while nearly all trucks and buses still use frames.

Design Features

While appearing at first glance as a simple hunk of metal, frames encounter great amounts of stress and are built accordingly. The first issue addressed is beamheight, or the height of the vertical side of a frame. The taller the frame, the better it is able to resist vertical flex when force is applied to the top of the frame. This is the reason semi-trucks have taller frame rails than other vehicles instead of just being thicker

Types of frames

Ladder Frame:

It is so named for its resemblance to a ladder; the ladder frame is the simplest and oldest of all designs. It consists merely of two symmetrical rails, or beams, and crossmembers connecting them.

Backbone tube:

Backbone chassis is a type of an automobile construction chassis that is similar to the body-on-frame design instead of a two-dimensional ladder type structure.

Unibody:

By far the most common design in use today, sometimes referred to as a sort of frame but the distinction still serves a purpose: if a unibody is damaged in an accident, getting bent or warped, in effect its frame is too, and the vehicle un drivable. If the body of a body-on-frame vehicle is similarly damaged, it might be torn in places from the frame, which may still be straight, in which case the vehicle is simpler and cheaper to repair.

Sub Frame:

The sub frame, or stub frame, is a boxed frame section that attaches to a unibody. Seen primarily on the front end of cars, it's also sometimes used in the rear. Both the front and rear are used to attach the suspension to the vehicle and either may contain the engine and transmission.

Body-on-frame:

It is an automobile construction method. Mounting a separate body to a rigid frame that supports the drivetrain was the original method of building automobiles, and its use continues to this day. The original frames were made of wood (commonly ash), but steel ladder frames became common in the 1930s. It is technically not comparable to newer

monologue designs, and almost no modern vehicle uses it (other than trucks).

In the USA the frequent changes in automobile design made it necessary to use a ladder frame rather than monologue to make it possible to change the design without having to change the chassis, allowing frequent changes and improvements to the car's bodywork and interior while leaving the chassis and driveline unchanged, and thus keeping cost down and design time short. It was also easy to use the same chassis and driveline for several very different cars. Especially in the days before computer aided design

Body-on-frame remains the preferred construction method for heavy-duty commercial vehicles, especially those intended to carry or pull heavysuch as trucks.



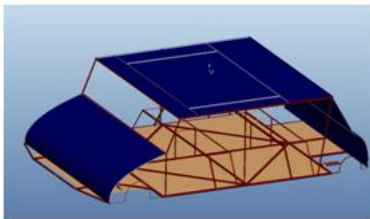
Advantages over unibody:

- Easier to design, build and modify (less of an issue now that Computer-Assisted Design (CAD) is commonplace, but still an advantage for coach-built vehicles).
- Quieter, because the stresses do not pass into the body, which is isolated from the frame with rubber pads around the attachment bolts. Less significant lately, but earlier bodies would squeak and rattle, ever more as they rusted, lubricants drained, and fasteners loosened. Isolated bodies had a lesser degree of these modes of aging.
- Easier to repair after accidents. This is crucial for taxicabs, because damaged bolt-on fenders can be replaced in the firm's own garage - for petty cash, with the cab returned to earning status immediately - whereas a monologue body would require straightening by paid specialists on a machine expensive to rent - with the cab laid up for repair longer
- GrandAm allows tubular spaceframe cars to replace their monologue counterparts, as the cars can easily be repaired with new clips.

Styles in current use:

- Buggy:-
A Buggy is an automobile with wheels that project beyond the vehicle body.
- Cabrio coach or Semi-convertible:-
It is a form of car roof, where a retractable textile cover amounts to a large sunroof, sometimes and an option on modern cars.

- Convertible or cabriolet:-
A body style with a flexible textile folding roof or rigid retracting roof.
- Coupé:-
It is a 2-door, 2- or 4-seat car with a fixed roof.
- Coupe utility (Ute):-
The coupé utility is a passenger-car derived vehicle with coupé passenger cabin lines and an integral cargo bed.
- Estate car:-
It is a British name for a station wagon.
- Fastback:
It is the design where the roof slopes at a smooth angle to the tail of the car.
- Hatchback:-
It incorporates a shared passenger and cargo volume, with rearmost accessibility via a rear third or fifth door, typically a top-hinged liftgate.
- Leisure activity vehicle:-
A small van, generally related to a supermini, with a second or even a third seat row, and a large, tall boot.
- Sedan:-
It is a car seating four or more with a fixed roof that is full-height up to the rear window.



STEERING MECHANISM

STEERING SYSTEM

It is the system which provides directional change in the performance of an automobile. This system converts rotary movement of the steering wheel into angular movement of the front wheels.

Steering system requirements and functions

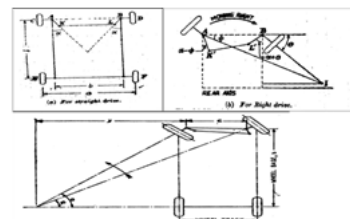
1. It should multiply the turning effort applied on the steering wheel by the driver. 2. It should be to a certain extent irreversible. In other words, the shocks of the road surface encountered by the wheels should not be transmitted to the driver's hands. 3. The mechanism should have self rightening effect i.e., when the driver releases the steering wheel after negotiating the turn, the wheel should try to achieve straight-ahead position. Functions of the steering system are as follows:

- a) It helps in swinging the wheels to the left or right.
- b) It helps in turning the vehicle at the will of the driver.
- c) It provides directional stability.
- d) It helps in controlling wear and tear of tires.
- e) It helps in achieving the self-rightening effect.
- f) It converts the rotary movement of the steering wheel into an

angular turn of the front wheels. g) It multiplies the effort of the driver by leverage in order to make it fairly easy to turn the wheels. h) It absorbs a major part of the road shocks thereby preventing them to get transmitted to the hands of the driver

Ackermann steering gear mechanism:

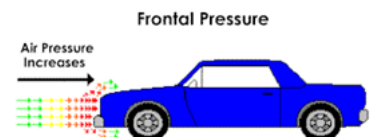
The Ackermann steering gear mechanism consists of a cross link KL connected to the short axles AC and BD of the two front wheels through the short arms AK and BL, forming bell crank levers CAK and DBL respectively. When the vehicle is running straight, the crosslink KL is parallel to AB, the short arm AK and BL both make angle α to the horizontal axis of chassis. In order to satisfy the fundamental equation for correct steering, the links AK and KL are suitably proportioned and angle α is suitably selected



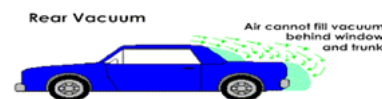
AERODYNAMICS

Drag:

A simple definition of aerodynamics is the study of the flow of air around and through a vehicle, primarily if it is in motion. To understand this flow, you can visualize a car moving through the air. As we all know, it takes some energy to move the car through the air, and this energy is used to overcome a force called Drag.



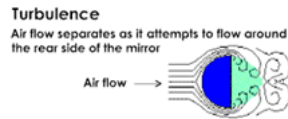
Rear vacuum (a non-technical term, but very descriptive) is caused by the "hole" left in the air as the car passes through it. To visualize this, imagine a bus driving down a road. The blocky shape of the bus punches a big hole in the air, with the air rushing around the body, as mentioned above



Flow detachment applies only to the "rear vacuum" portion of the drag equation, and it is really about giving the air molecules time to follow the contours of a car's bodywork, and to fill the hole left by the vehicle, its tires, its suspension and protrusions (ie. mirrors, roll bars). If you have witnessed the Le Mans race cars, you will have seen how the tails of these cars tend to extend well back of the rear

wheels, and narrow when viewed from the side or top

Turbulence generally affects the "rear vacuum" portion of the drag equation, but if we look at a protrusion from the race car such as a mirror, we see a compounding effect. For instance, the air flow detaches from the flat side of the mirror



Lift (or Down force)

One term very often heard in race car circles is Down force. Down force is the same as the lift experienced by airplane wings, only it acts to press down, instead of lifting up



Drag Coefficient

The shape of a car, as the aerodynamic theory above suggests, is largely responsible for how much drag the car has. Ideally, the car body should:

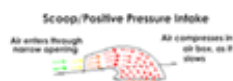
- Have a small grill, to minimize frontal pressure.
- Have minimal ground clearance below the grill, to minimize air flow under the car.
- Have a steeply raked windshield to avoid pressure build up in front.
- Have a "Fastback" style rear window and deck, to permit the air flow to stay attached.
- Have a converging "Tail" to keep the air flow attached.

Frontal Area

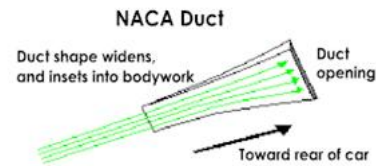
Drag coefficient, by itself is only useful in determining how "Slippery" a vehicle is. To understand the full picture, we need to take into account the frontal area of the vehicle.

Scoops

Scoops, or positive pressure intakes, are useful when high volume air flow is desirable and almost every type of race car makes use of these devices. They work on the principle that the air flow compresses inside an "air box", when subjected to a constant flow of air.



NACA Ducts



NACA stands for "National Advisory Committee for Aeronautics". NACA is one of the predecessors of NASA. In the early days of aircraft design, NACA would mathematically define airfoils (example: NACA 071) and publish them in references, from which aircraft manufacturers would get specific applications

Spoilers

Spoilers are used primarily on sedan-type race cars. They act like barriers to air flow, in order to build up higher air pressure in front of the spoiler. This is useful, because as mentioned previously, a sedan car tends to become "Light" in the rear end as the low pressure area above the trunk lifts the rear end of the car. See the diagram below:



Wings

Probably the most popular form of aerodynamic aid is the wing. Wings perform very efficiently, generating lots of down force for a small penalty in drag



ELECTRICAL SYSTEM:Electrical system includes starting system, charging system, ignition system and lighting system and some accessories

Charging System(a) Alternator(b) Regulator, etc.**Starting System**(a) Battery(b) Starting motor(c) Wiring,(d) Switches, etc.

Ignition System:

In spark ignition engines, a device is required to ignite the compressed air-fuel mixture at the end of compression stroke

Charging system:

Charging system is required to recharge the battery which is an important component of electrical system of an automobile

Suspension system:

The need of suspension system in automobiles:

To provide good ride and handling performance
—vertical compliance providing chassis isolation—
ensuring that the wheels follow the road profile—
very little tire load fluctuation

To provide isolation from high frequency vibration from tire excitation

—requires appropriate isolation in the suspension joints

—Prevent transmission of ‘road noise’ to the vehicle body



Types of Suspension system:

Mainly it is divided into two types:

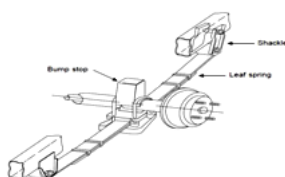
1. Dependent type
2. Independent type

Dependent type:

- 1 Hotchkiss drive
- 2.Semi dependent suspension system

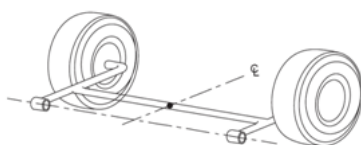
Hotchkiss drive:

Axle is mounted on longitudinal leaf springs, which are compliant vertically and stiff horizontally. The springs are pin-connected to the chassis at one end and to a pivoted link at the other. This enables the change of length of the spring to be accommodated due to loading



Semi dependent suspension system:

The rigid connection between pairs of wheels is replaced by a compliant link. A beam which can be bend and flex providing both positional controls of the wheels as well as compliance. It tends to be simple in construction but lack scope for design flexibility



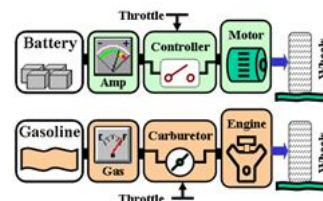
MOTORS:

In this vehicle we replace the IC engine with dc electric motors. It is rear wheel drive car. The motors are connected on rear axle. We control the motor speed by controllers. It means the electrical power is goes first to controller and then, motor so we control motor speed.

An electric motor is all about magnets and magnetism: A motor uses magnets to create motion. If you have ever played with magnets you know about the fundamental law of all magnets: Opposites attract and likes repel. So if you have two bar magnets with their ends marked "north" and "south," then the north end of one magnet will attract the south end of the other.



POWER TRAIN



The energy in e car is electric power .means using batteries. The electric power is stored in batteries .from the batteries power goes to controller .the controller is control the motor speed. It varies the voltage. In this we are using 600W controller. The controller connected to potentiometer .it varies the current supply to motors so the speed also varies .and it connected to brakes, when we apply brakes it cut off the power supply. In running cut off the power supply, the motor act as the generator, means it generate the electric power .it is also stored.

III. CONTROLLING SYSTEM

The controlling system means the total vehicle controlled by this system. In the system main components are

1. Controller
2. Potentiometer
- 3.Reverse gearing system

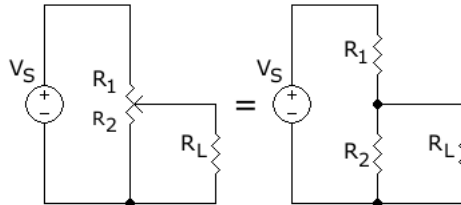
CONTROLLER:-

The controller on an electric vehicle is the device or method by which the speed and power output of the drive motor is controlled, much in the way the throttle plates in a carburetor or throttle body control the power output of a gas engine

POTENTIOMETER:

A rheostat is a two-terminal variable resistor. Often these are designed to handle much higher voltage and current. Typically these are constructed as a resistive wire wrapped to form a toroid coil with the wiper moving over the upper surface of the toroid, sliding from one turn of the wire to the next

Theory of operation:



A potentiometer with a resistive load, showing equivalent fixed resistors for clarity.

The potentiometer can be used as a voltage divider to obtain a manually adjustable output voltage at the slider (wiper) from a fixed input voltage applied across the two ends of the pot. This is the most common use of pots.

ACCELERATOR: It is the system which is used to increase/decrease the speed of the vehicle. It controls the speed of the motor via controller.

BRAKING SYSTEM: A brake is a mechanical device which inhibits motion. The rest of this article is dedicated to various types of vehicular brakes.

Most commonly brakes use friction to convert kinetic energy into heat, though other methods of energy conversion may be employed.

CHARGING SYSTEM

Our main task is to charge the battery to move our vehicle and it can be done here in our saura by three ways:

1. Charging the batteries by A.C.Current
2. By using solar panels
3. by using Engine-Dynamo Mechanism

BATTERIES

A gel battery is also known as a "gel cell" and gets its name from the jellified electrolyte employed to reduce electrolyte evaporation and spillage which often leads to corrosion problems. Gel batteries are known for better resistance to extreme temperatures, shock, and vibration and do not even need to be kept upright.

General Specifications:

Input voltage 88~132VAC/ 176~264VAC
selected by switch.

249~370VDC

Input frequency 47 ~ 63Hz

AC current (typ.) 4.5A/115VAC 2.5A/230VAC

Leakage current <3.5mA / 240VAC

Rated power 216W

Setup, rise time 200ms, 100ms at full load

Hold time 30ms at full load

Overload protection 105% ~ 135% rated output power

Over voltage protection type: Constant voltage limiting, recovers automatically after fault condition is removed

Working temp -10~+60Â°C (refer to output load derating curve)

CHARGING THE BATTERY BY USING SOLAR PANELS:

Solar Panels:

They solar panels supply the electricity and charge the batteries.

There are 3 Basic types of Solar Panels:

1. Mono crystalline solar panels
2. Polycrystalline solar panels
3. Amorphous solar panels

CHARGING THE BATTERY BY USING ENGINE-DYNAMO MECHANISM:

ENGINE-DYNAMO MECHANISM:

The third way of charging the battery is done by using the setup which consists of Engine –dynamo which are mounted on a base

2-STROKE ENGINE:

A two-stroke, two-cycle, or two-cycle engine is a type of internal combustion engine which completes a power cycle in only one crankshaft revolution and with two strokes, or up and down movements, of the piston in comparison to a "four-stroke engine", which uses four strokes.

Two Stroke Petrol Engine:

Fig. shows a two stroke petrol engine. It has no valves but consists of inlet or induction port (IP), exhaust port (EP), and a third port called the transfer port (TP).

let the piston be nearing the completion of its compression stroke. The ignition starts due the spark given by the spark plug and the piston is pushed down performing the working strokes and in doing so the air fuel mixture already drawn from the inlet port in the previous stroke is compressed to a pressure of about 1.4 bar. When about 4/5th of this stroke is completed the exhaust port (EP) is uncovered slightly and some of the burning gases escape to the atmosphere. Immediately afterwards as the exhaust port is uncovered by the further downward movement of the piston, the transfer port which is only very slightly lower than exhaust port is also uncovered and a charge of compressed fuel air mixture enters the cylinder and further pushes out the burnt gases out of the exhaust port. The top of the piston is made of a particular shape that facilitates the deflection of fresh charge upwards and thus avoids its escape along with the exhaust gases. This process is known as scavenging. After reaching the bottom dead center when the piston moves up, it first closes the inlet port, then transfer port and then exhausts port. The charge of fuel which previously entered the cylinder is now compressed. Simultaneously there is a fall of pressure in the crank case, creating a partial vacuum. When the piston is nearing the upward movement, the inlet port opens and a fresh charge of air fuel mixture from the carburetor enters the crank case. After the ignition of the charge, the piston moves down for the power stroke and the cycle is repeated as before.

DYNAMO:

DESCRIPTION:

The dynamo uses rotating coils of wire and magnetic fields to convert mechanical rotation into a pulsing direct electric current through Faraday's law of induction. A dynamo machine consists of a stationary structure, called the stator, which provides a constant magnetic field, and a set of rotating windings called the armature which turn within that field. The motion of the wire within the magnetic field causes the field to push on the electrons in the metal, creating an electric current in the wire

ENGINE-DYNAMO SETUP:

The task of charging the battery is done by the following setup:



ESTIMATED COST:

S.NO	ITEM	COST
1.	IRON	9000
2.	ELECTRICAL ITEMS	540
3.	ELECTRODES	890
4.	MOTORS & OTHER ITEMS	37000
5.	ENGINE	3000
6.	DYNAMO	1000
7.	PAINT	5000
8.	PLYWOOD	550
9.	BREAKING SYSTEM	1000
10.	SUSPENSION SYSTEM	2000
11.	STEERING MECHANISM	1200
12.	BUMPERS	4000
13.	HARDWARE PARTS	3000
14.	RADIUM STICKERS	1200
15.	FRONT FIBRE	1500
16.	SOLAR PANELS	6090
17.	CHARGE CONTROLLER	1500
18.	MISCELLIANEOUS CHARGES	10000
	TOTAL	88470

IV. CONSLUSION

We have designed the SAURA-THE HYBRID CAR using AUTOCAD & PRO-E software's. We have calculated all the designed parameters. We conclude that it is of Eco-friendly and is of low cost while comparing with the normal E-Cars. It has the following advantages:

1. It has power differential
2. We are using two motors for running the car where as normal car uses a single motor.
3. It has less rotating parts.

V. REFERENCES

- [1]. Thermo Dynamics - R.S.Khurmi
- [2]. Automobile Engineerin -HasrajChowdary
- [3]. Engineering Mechanics- Bhavakatti

AUTHOR's PROFILE



A PramodKumar was born in Kothaguda(Vil) ,Kandukur (mdl),Ranga Reddy (Dist),Telangana, India, in 1993. He received the B.Tech. degree in Mechanical engineering from the JawaharallaTechnological University,Hyderabad, India, in 2014, and Pursuing M.Tech from JNTU ,Hyd .In 2015, he joined the Department of Mechanical Engineering, Annamacharya Institute Of Technology, Hyderabad , as a **Assistant professor**, and later he joined in the Department of Mechanical Engineering, Nishitha College Of Engineering & Technology, Hyderabad , as a **Assistant professor**.



M.NIRISH (M') was born in india in 1991. He **received** the B.Techin mechanical engineering and M.Tech in Machine design from the Jawaharlal Nehru University of Hyderabad in 2012 and 2014, respectively. Since then, He was worked as an assistant professor of department of Mechanical engineering Aurora Scientific Technology Research and Academy, Hyderabad, India From 2012-2015 . He joined the department of Mechanical engineering, Nishitha college of engineering and Technology, as an Asst. Prof.